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SCIENCE TRENDS

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Energy and Propulsion

Here is a brief summary of progress in major non-conventional power sources as outlined before Congress during the past week:

Ion Propulsion -- Dr. Robert H. Fox, Lawrence Radiation Laboratory, University of California, Livermore, Calif., says there is every reason to believe that at least 50 percent efficiency can be achieved with such techniques and that 80 or 90 percent may be possible. Ion propulsion devices for manned planetary exploration are at least 15 to 20 years, and possibly as high as 30 years in the future.

Snap 8 -- National Aeronautics and Space Administration confirms that it will proceed with development of this advanced nuclear turboelectric plant (SCIENCE TRENDS, Nov. 23, 1959) and is negotiating with Aerojet General Corp for conversion system. The \$8 million unit is expected to be ready for flight test in about five years, although no contract for a vehicle has been signed. Snap 8 is expected to weigh about 1,500 pounds with reactor, being developed by Atomics International, and is expected to supply 30,000 watts of power for about a year. Follow-on would be a dual version using a single reactor, providing 60,000 watts.

Project Orion: Dr. Stanislaus Ulam, Los Alamos Scientific Laboratory urges continued study and development of this project, in which a series of pulsed nuclear explosions would provide propulsion for space vehicles weighing "thousands of tons." "Mock-up" experiments using ordinary chemical explosions to study ablation of the exposed surface and other effects is recommended. A shortage of funds and lack of decision by the Pentagon now threatens further development.

Thermionic Conversion: Dr. G.M. Grover, Los Alamos Scientific Laboratory reports continued progress with the cesium plasma diode or "plasma thermocouple" device for direct conversion of fission energy into electrical energy. Studies now indicate that for space applications it should be possible to build a complete power supply using plasma cells with a specific power of greater than 100 watts per pound. Efforts will now be made to experimentally verify this prediction.

(Complete transcripts of these and other presentations will be available at a future date. Subscribers will be informed promptly when copies are available)

* Air Force Contract Management

Reorganization of Air Force contract management offices is planned for the first quarter of the Fiscal Year which begins July 1. At that time all air procurement districts and Air Force plant representatives offices will fall under jurisdiction of one of three geographical regions.

Each region will have responsibilities for production, quality control and other staff functions. Air Force procurement districts will maintain their prime responsibility for administering contracts initiated by the Air Force and other Governmental agencies, and will continue to be based in their present locations.

Eastern Contract Management Region Headquarters will be located at Olmsted Air Force Base, Pa.; Central Headquarters will be located at Wright-Patterson Air Force Base, Ohio and Western Headquarters will be at Mira Loma Air Force Station, Calif.

* Non-Destructive Testing

Atomic Energy Commission will sponsor an unclassified symposium on non-destructive testing of reactor materials at its headquarters near Washington, D. C. on May 20, 1960.

Purpose of the meeting is to acquaint industry with equipment and techniques in such fields as radiation, including radiography, production gages, spectrometry and x-ray; ultrasonics; electro-magnetic testing and leak, thermal and surface test methods.

(Attendance Free, advance registration not required. Further details available from Industrial Cooperation Branch, Division of Reactor Development, U.S. Atomic Energy Commission, Washington 25, D.C.)

* Reactor Proposals

Unsolicited proposals from industry for new reactor concept studies will now receive "immediate" consideration by the Atomic Energy Commission staff under revised procedures disclosed this week. The Commission has abolished its New Reactor Concepts Board which met twice a year to evaluate such proposals.

* Communication Satellites

Defense Department is shuffling its communications satellite programs. Projects Steer, Tackle and Decree, all calling for various types of instantaneous repeaters will now be grouped together as Project Advent. Courier delayed repeater project remains unchanged. Advanced Research Projects Agency Director Brg. Gen. A. W. Betts says that any crash program for launching of a so-called real time repeater satellite would be "pouring money into a rat hole" without reliable elements operating at the best frequencies. Premature emphasis on flight testing, he declares, "would delay rather than speed up" the program.

Materials Research and Development

Background: A special Committee on Scope and Conduct of Materials Research has reported that the Government should reorganize many of its programs for support of materials research and should expand R&D in Government, industry and educational organizations. Major findings and conclusions:

- * "Hardware" Needs: National security and progress demands new and improved materials and fabricating techniques. This will require new and highly expensive laboratory and pilot plant facilities not now available. This is particularly true in the forming or shaping of new metals, alloys or composite materials with high-melting points; and in materials which will have to function in non-conventional environments such as extreme temperatures, pressures, electromagnetic fluxes and extreme corrosion. Since only limited quantities of super-property materials may ever be required, industry cannot be expected to bear the cost without Government incentives.
- * Coordination Required: There is a clear need for better coordination within and between the military services and civilian Government agencies concerned with materials research. Department of Defense, in particular, should establish centralized funding for R&D on long-range needs supplementing and coordinating work supported by the Army, Navy and Air Force.
- * Government Incentives: Government contracts, based on competence, should be encouraged and expanded with institutes, university research groups, industrial concerns or even individuals. These contracts should permit purchase of equipment and construction of facilities, where required, and contracts should run as long as three to five years. Typical deficiencies in facilities are said to include equipment for preparation and analysis of ultra-pure single crystals or thin films; for high temperature fabrication of refractory metals, or for high pressure and high-temperature synthesis of new compounds.
- * Stockpiles: The national needs require assurance of adequate supplies of every useful element to permit prospective users to design and specify items with confidence they will not be hindered by materials shortages. Examples are said to include Tellurium, not now on any stockpile list although potential uses in thermoelectric devices to convert heat energy to electricity could be very great; Rhenium, not now on any stockpile list although there is a very great chance of future high-temperature applications and Tantalum. Tantalite is now stockpiled but potential uses in high-temperature alloys and compounds and in electronic capacitors could require much greater supplies.
- * Information and Education: The Government should take the lead in providing rapid and accurate sharing of information on advanced materials R&D. Substantially greater efforts should be made in the collection, correlation and dissemination of information. Government support is also urged to support the training of increased numbers of scientists and engineers competent to deal with materials problems, preferably on an interdisciplinary basis. Universities should also be aided in basic materials research studies and should be encouraged to enlist the aid of engineering in many areas which are outside the scope of the "pure" sciences.

Research Checklist

- () Uranium-Platinum System: The alloying behavior of uranium is being studied by the National Bureau of Standards in a project which may have application in nuclear power and other fields where high temperatures are encountered. Work on a uranium-platinum system has already indicated that at least one of the compounds studied has a melting point of 1,700°C and passes directly from solid to liquid. Experiments also made it apparent that platinum dissolves in solid uranium and uranium can be dissolved in solid platinum.
- (For further details write Office of Technical Information, National Bureau of Standards, Washington 25, D.C. for STR-Uranium-Platinum)
- () Aircraft Radio Static: Precipitation static caused when aircraft fly through snow or clouds of ice particles is said to be eliminated by a special discharge device developed during studies for the U.S. Air Force. The units are designed to prevent the noise generated by corona discharges (St. Elmo's Fire) from reaching the aircraft's radio antennas. Devices incorporate a sharp tungsten pin supported by a resistively coated plastic cement for attachment at all points on the aircraft at which such discharges occur. The static discharges are also said to be effective in carrying off charge created by jet-engine exhausts. The units are being considered for installation on future Boeing 707s.
- (R&D by Stanford Research Institute, Menlo Park, Calif.)
- () Gun Barrel Radiation Shield: Researchers at the Brookhaven National Laboratory have converted a section of a Navy 8-inch rifle for use as a low-level beta counter radiation shield. The 4-foot, 7000 pound section has proven an excellent device for the reduction of the background counting rate due to cosmic rays and other environmental radiations. The barrel was made from pre-war steel, further reducing radioactivity.
- () Coil Type Level Gauge: Sodium Reactor development studies for the Atomic Energy Commission have led to the design and construction of a coil type level gauge which is said to have an accuracy of plus or minus one inch and will operate continuously at 1000°F. In addition, the new gauge requires no prior calibration, can be replaced without opening the liquid metal system, and can be adapted to automatic operation and recording.

(Details available. 25 pages. 75 cents. Write OTS, U. S. Department of Commerce, Washington 25, D.C. for Pub. NAA-SR-4195)

- () Air-Launched Missiles: A new wind-tunnel method for studying various effects connected with the launching of missiles from aircraft has been developed by the National Aeronautics and Space Administration. The technique involves firing dynamically-scaled missile models and the measurement of rocket-motor sound and pressure fluctuations. This method is expected to aid in the design of systems where asymmetrical flow conditions exist or where high-frequency pressure pulsations of a rocket motor might cause structural damage to the aircraft.

(Report Available. Single Copies Free. Write NASA 1520 H Street, N.W., Washington 25, D.C. Attn: Code BID, for Technical Note D-224)

- () Solid Propellant Gas Generator: A compact solid propellant gas generator developing sufficient horsepower to generate electrical power and drive the hydraulic system on Navy Tartar and Terrier missiles has been developed. A unique feature is said to be a boost disc of fast-burning propellant cemented to the starting end of the main propellant charge. The disc provides the rapid power required to start system turbines. A clean-burning extruded ammonium nitrate propellant is used which leaves no detrimental deposit on turbine blades. A combination nitrate-perchlorate oxidizer is used in the boost disc.

(Generator R&D by Solid Propulsion Operations, McGregor, Tex, Rocketdyne Division of North American Aviation, Inc.)

- () New Brake Fluid: Army Ordnance had developed and tested an improved preservative brake fluid for automobiles and trucks which has proved successful in storage up to 30 months and in operation to 0°F. The fluid is said to have an acceptable boiling point, and causes little deterioration.

(Formula and further details available. 21 pages. 75 cents. Write OTS, U. S. Department of Commerce, Washington 25, D.C. for Aberdeen Proving Ground Report PB 161 096)

- () Orthopotoscope: Stereophotogrammetric principles are used to produce photographs said to be free from image displacement due to camera tilt or topographic relief in this new instrument developed for the U. S. Geological Survey. Two overlapping aerial photographs are projected to form a 3-dimensional image on a moving screen. The screen has a small center slit, and the light that passes through strikes a photographic film. An operator views the images on the screen and raises or lowers the screen and the film so that the slit skims the surface of the ground as it appears in the 3-dimensional image. The Survey reports that in this way the entire image pattern can be brought to one uniform scale.

Publication Checklist

- () Military Construction, a transcript of hearings on construction projects of the various service agencies in the U. S. and overseas. Single Copies Free. (Write Committee on Armed Service, U. S. House of Representatives, Washington 25, D. C. for Hearings, Military Construction Authorization No. 42)
- () Military Procurement and Supply, a background report on the economic aspects of this problem, dealing with supply management and the so-called single manager system. 236 Pages. Single Copies Free. (Write Joint Economic Committee, U.S. Congress, Washington 25, D.C.)
- () Radioisotope Teletherapy Equipment, an international directory of equipment using radioisotope sources for treatment of malignant tumors, including all necessary specifications. 120 Pages. \$2. (Write Publications Office, International Atomic Energy Agency, Karntnerring 11, Vienna 1, Austria)
- () Atomic Test Ban Problems, testimony and information submitted to Congress on technical problems concerned with proposed bans on nuclear testing. 85 Pages. Single Copies Free. (Write Subcommittee on Disarmament, Committee on Foreign Relations, U.S. Senate, Washington 25, D.C. for Hearings, Technical Problems and the Geneva Negotiations)
- () Army Research and Development, a guide for R&D contractors interested in performing work for the U.S. Army or its various installations. Single Copies Free. (Write Central Military Procurement Information Office, Office of the Assistant Secretary of Defense (S&L) Room 3E-821, The Pentagon, Washington 25, D.C. for Contractors Guide, Research and Development in the U.S. Army)
- () Exponential Atmosphere, an outline of the background and development of an exponential model of atmospheric radio refractivity. Includes a set of ray tracings for the model in the form of tables of refraction variables. 67 Pages. 45 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Pub. C 13.44:4)
- () Monte Carlo Method, a 1959 literature survey of 114 unclassified references on the "Monte Carlo" technique of applying statistical methods of random sampling to physical and mathematical problems to which a probability analysis can be applied. 12 Pages. 50 cents. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for Publication TID 3541)
- () Electronic Cooling Methods, a June 1959 handbook, now available, which can serve as an excellent guide to electronic engineers interested in the thermal design of equipment. It discusses various modes of heat transfer and presents theory, data and computational methods for the achievement of satisfactory designs. 605 Pages. \$8. (Write OTS, U.S. Department of Commerce, Washington 25, D. C. for PB 161 264)
- () Materials Research and Development, the full text of a report summarized in this issue. 24 Pages. \$1 (Write Publishing Office, National Academy of Sciences, Washington 25, D.C. for Pub. No. 718)

